Utah DOT Fog Dispersal Operations

In northern Utah widespread, super-cooled fog (i.e., less than 32 degrees F) can persist in mountain valleys for weeks. Utah Department of Transportation (DOT) maintenance personnel use liquid carbon dioxide to disperse fog and improve visibility along segments of Interstates 15, 70, 80, and 84; US Highways 40, 89, and 91; as well as secondary roads in Cache Valley and Bear Lake Valley. This treatment strategy includes the application of anti-icing chemicals as fog is dispersed to prevent moisture from freezing on the pavement.

System Components: Fog dispersal equipment, comprised of commercially available products, is installed on roughly 70 maintenance vehicles or 15 percent of the fleet. Each truck is equipped with a compressed gas cylinder, a manual valve assembly, mounting brackets, copper pipe, and a dispensing nozzle. Each cylinder holds liquid carbon dioxide at a pressure of 2,000 pounds per square inch (psi).

System Operations: Before vehicles leave the maintenance yard for normal patrol duties, the cylinder and valve assembly are attached. Dispensers are turned on when maintenance vehicles leave the yard and turned off when they return. As the vehicles travel through super-cooled fog, very small amounts of liquid carbon dioxide are sprayed into the slipstream of the truck. The carbon dioxide quickly evaporates removing heat from water droplets in the fog. The droplets form ice crystals and precipitate as fine snow or ice.

Maintenance Vehicle equipped with Fog Dispersal Equipment

To prevent the precipitate from freezing on the road surface, anti-icing chemicals are simultaneously applied. If the air temperature is below 20 degrees F (-6.7 degrees C), common road salt is prewetted with liquid magnesium chloride and applied to pavements. Road salt or sodium chloride brine is spread when the air temperature is above 20 degrees F.

Transportation Outcome: The fog dispersal treatment strategy improves roadway mobility and safety. This strategy can increase visibility distance behind the maintenance vehicle from 33 feet (10 meters) to 1,640 feet (500 meters) in less than 30 minutes. The treatment remains effective for 30 minutes to 4 hours, depending upon air temperature and wind speed. Improved visibility has significantly reduced rear-end crashes into maintenance vehicles, enhancing the safety of DOT personnel and the public.

Implementation Issues: In 1990 the DOT's Research Division sponsored a University of Utah research grant to investigate fog control at a bridge location. During the study university researchers noticed that a tunnel of clear visibility formed in the fog as carbon dioxide was dispensed. In 1992 DOT and university researchers developed a prototype with customized hardware components and began the field testing of mobile fog dispersal techniques. The Research Division published field trial results in 1993.

Based upon recommendations in the field trial report and lessons learned from anti-icing operations near Salt Lake International Airport, maintenance personnel configured a truck with fog dispersal equipment composed of commercial-off-the-shelf products. This configuration was more cost effective than the customized configuration developed by the University, which was prohibitively expensive.

Before fog dispersal equipment was deployed in 2000, the DOT developed a two-hour training course to ensure employee safety when working with compressed liquid carbon dioxide. Training course topics included oxygen-displacement properties of the chemical, chemical handling techniques, and operation of the high-pressure dispenser.

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